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ABSTRACT

This guidebook presents facility guidelines to aid the school planner in determining appropriate facilities for a model curriculum. The first of four major sections, The Intent of Industrial Arts, discusses the mission and goals, instructional objectives, function of industrial arts, and the model curriculum. Section 2 focuses on facilities for elementary, junior high, and senior high programs. Section 3 addresses architectural considerations such as location and housing, flexibility and expansion, space needs, open laboratory/instructional area, auxiliary rooms, visual comfort and efficiency, ventilation and heating, and floors and surfaces. The final section presents a planning summary of the industrial arts curriculum, suggested industrial laboratories, industrial arts laboratory space needs, industrial arts courses accomodated by respective laboratories, and equipment guidelines. (LRA)

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INDUSTRIAL ARTS
FACILITY PLANNING GUIDE

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E.A.B.

FOREWORD

The Industrial Arts curriculum has a boundless potential for courses and program development. Scores of courses are currently provided, while potentially hundreds could be offered. Although this program possibility excites the imagination it indicates the significance in determining what should be of greatest value for the student to experience.

Thus, the development of an appropriate, or model curriculum requires a critical examination of several undergirding questions: What is the overall responsibility of Industrial Arts? What Industrial Arts goals are appropriate for the different grade or school levels? What courses constitute a meaningful curriculum for these goals to be realized? What shall be the scope and sequence of the total curriculum? The answers to these questions have been addressed by a Virginia Industrial Arts Curriculum Council and are presented in the program materials included herein and are referred to as the Model Curriculum.

This publication basically presents facility guidelines to aid the school planer in determining appropriate facilities for a model curriculum. It has been developed with the intent of guiding facility construction and remodeling to match the development of the most appropriate curriculum in Industrial Arts.

INTRODUCTION TO INDUSTRIAL ARTS

Industrial Arts is an activity-oriented program that teaches students about industry and technology. It involves students in numerous activities which either simulate or replicate industrial activities and technological developments.

The program capitalizes on the rich potential of the individual's natural ability for reasoning and problem solving, for imagining and creating, for construction and expressing with materials - from which comes technology and industry.

Industrial Arts is a basic and fundamental study for all persons regardless of educational goals or occupational pursuit.

INDUSTRIAL ARTS CAN HELP THE STUDENT TO:

* gain an understanding of industry and technology
* discover interests and talents
* develop techniques in problem solving
* develop basic skills in the safe use of tools and machines
* make informed and meaningful occupational choices
* acquire interests in avocational pursuits and hobbies
* develop safe working habits
* apply other school subjects
* become a wiser consumer
* develop creativity
* develop pride in work well done
* work cooperatively with others

THE INTENT

OF

INDUSTRIAL ARTS

MISSION OF INDUSTRIAL ARTS EDUCATION

The mission of Industrial Arts Education is to assist each student to develop understanding about all aspects of industry and technology, and aid in the discovery and development of individual potential.

GOALS

Consistent with their abilities, interests and educational needs;

1. Students at the elementary school level will receive learning reinforcement, through the use of simple tools, materials and processes, that contribute to personal development and technological awareness.

2. Students at the middle or junior high school level will be aware of employment and/or self-employment opportunities and requirements for use in making career choices and in determining their educational programs.

3. Students at the senior high school level will acquire competencies that lead to responsible citizenship through technological understanding, consumer knowledge, and the productive use of leisure time.

4. Students at the senior high school level will acquire technical competencies in preparation for advanced vocational or technical education programs.

CONTINUING INSTRUCTIONAL OBJECTIVES

The Industrial Arts program stresses the following instructional objectives:

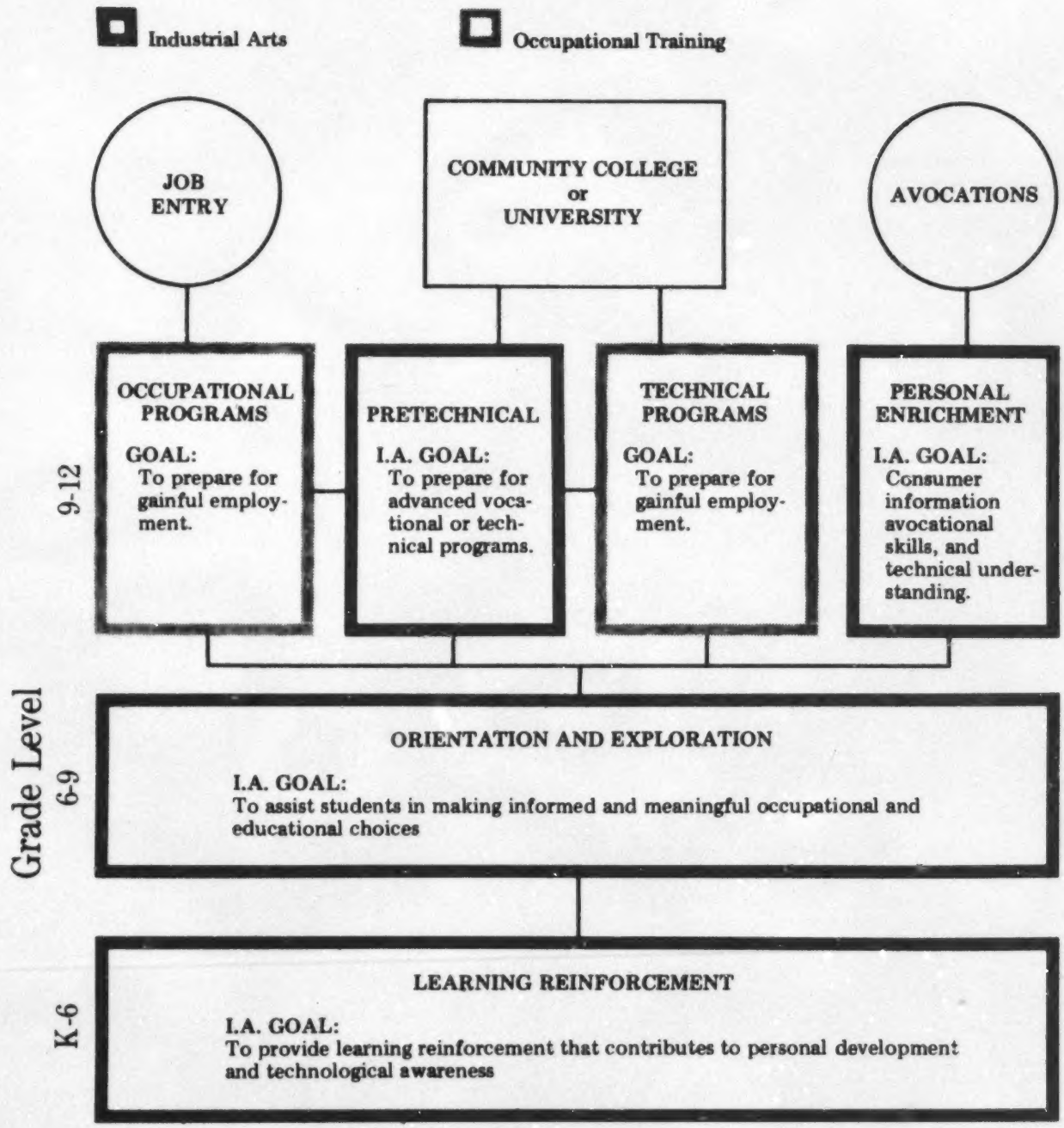
1. To develop in each student an insight and understanding of technology and industry and their place in our society and the free enterprise system.

2. To discover and develop individual talents, attitudes, interests and potentials as related to industry and technology.

3. To develop technical problem-solving skills related to materials and processes.

4. To develop in each student basic skills in the safe use of the common tools and machines.

The Function of Industrial Arts in Comprehensive Education



The Industrial Arts Curriculum

Level	Goal	Program
High School	Personal Enrichment	Mechanical Drawing Electricity/Electronics Graphic Arts General Industrial Arts Industrial Crafts Metalworking Woodworking Power Mechanics
	Pretechnical	Communications Technology Power and Transportation Technology Materials and Processes Technology
Middle or Junior High School	Orientation and Exploration	World of Manufacturing World of Construction Modern Industry and Technology Exploring Technology
Elementary School	Learning Reinforcement	Industrial Arts activities integrated within the elementary curriculum

FACILITIES

FOR

PROGRAMS

ELEMENTARY SCHOOL GRADES K-6

DESCRIPTION

Elementary school Industrial Arts activities are designed to be a means or teaching method for reinforcing the elementary curriculum. It provides opportunities for students to develop concepts and skills through concrete experiences. These experiences include the manipulation of tools and materials with instructional methods promoting discovery. It includes: teaching about technology, personal development of psychomotor skills and attitude development about technology's influence on society. The program of elementary school Industrial Arts is designed to further the attainment of educational objectives derived from the goals of the elementary school. The program places emphasis upon:

- Activities with tools, materials and technical processes;
- Integrating and enriching concepts in language arts, science, social studies, mathematics, and other areas in the elementary school;
- Appreciation of craftsmanship in others and the dignity of all useful work.

GOAL

Learning Reinforcement

To Provide learning reinforcement that contributes to personal development and technological awareness.

STANDARDS

1. Teacher Qualifications
   Elementary teacher shall have completed pre-service or in-service training in Industrial Arts activities for the elementary student.

2. Grade Level
   Grades K-6.

3. Integration with Curriculum
   Activities shall integrate with the total curriculum and help provide hands-on experiences that reinforce the curriculum.

ELEMENTARY SCHOOL GRADES K-6

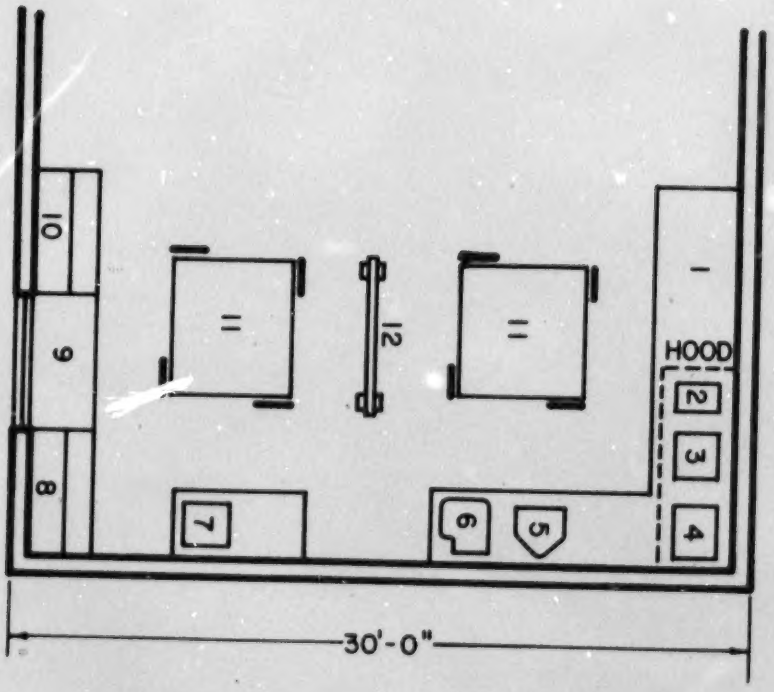
STANDARDS

4. Facilities, Equipment, and Supplies
The program can be implemented in existing classroom; however, tools, materials, and supplies shall be provided to accommodate student needs and activity requirements.

* * * *

Industrial Arts Area

Within Resource Center



RECOMMENDED EQUIPMENT LIST

FOR

INDUSTRIAL ARTS AREA WITHIN RESOURCE CENTER

No.	Description
1	Counter w/Cabinets Below
2	Soldering Furnace
3	Plastic Oven
4	Ceramic Kiln
5	Drill Press
6	Jig Saw
7	Sink
8	Ceramics Counter (Plastic Top)
9	Display Case
10	Finishing Counter (Metal Top)
11	4-Vise Bench w/Storage Below
12	Portable Tool Panel

MIDDLE OR JUNIOR HIGH SCHOOL GRADES 6-9

DESCRIPTION

Industrial Arts designed for the middle or junior high school provides the student with a broad base of try-out experiences and insights into career opportunities. This explanation gives a basis for personal assessment of work interests and aptitudes. Instruction at this level places emphasis upon:

- Using the tools, equipment, materials, and products associated with industry and technology;
- Role playing in simulated enterprise associated with a number of the career clusters;
- Studying and analyzing the materials, products, processes, problems, uses, developments, and contribution of many of the elements making up career clusters;
- Studying the organization of numerous industries or businesses while experiencing typical aspects of many;
- Researching, planning, designing, constructing, evaluating, and generalizing in association with problems, and projects related to various career clusters.

GOAL

Orientation and Exploration

To assist students in making informed and meaningful occupational and educational choices.

STANDARDS

To accomplish this purpose the middle or junior high school program shall provide:

1. Exploratory Experiences
   Orientation and exploration experiences in laboratories which will develop individual skill and creative abilities in the proper use of industrial tools, machines, processes and products.

MIDDLE OR JUNIOR HIGH SCHOOL GRADES 6-9

STANDARDS

2. Occupational Orientation
Occupational information, orientation, and instruction which will assist individuals to discover and develop talents, interest, attitudes and potential related to industry and technology.

3. Guidance and Counseling
Guidance and counseling for students to assist them in making informed and meaningful choices in selected occupational fields and in making appropriate educational choices.

4. Approved Courses
Approved courses include:
Exploring Technology
Modern Industry and Technology
World of Construction
World of Manufacturing

5. Grade Level
Early secondary, middle or junior high school level. Grades 6-9.

6. Teacher Qualifications
Teacher shall hold endorsement in Industrial Arts and have collegiate preparation through in-service or pre-service to implement the specific course assigned.

7. Student-Teacher Ratio
Class enrollment should not exceed 20 students per period per teacher.

8. Equipment
Laboratory equipment shall be provided for activities appropriate to the course offered.

9. Materials and Supplies
Instructional materials and supplies shall be provided to accommodate each student's needs within the context of the course enrolled.

10. Facilities
Instructional laboratory shall adequately accommodate all students enrolled. Typically 25% of the school population will be enrolled in Industrial Arts at any given time.

TABLE 1

MIDDLE OR JUNIOR HIGH SCHOOL
INDUSTRIAL ARTS LABORATORIES SUGGESTED*

INDUSTRIAL ARTS ENROLLMENT*	NUMBER OF LABS	EXAMPLES LABORATORIES NEEDED	TOTAL SPACE NEEDS SQ. FT.
To 120	One	General	3500
160 to 240	Two	Exploring Technology Industry and Technology	7000
280 to 360	Three	Exploring Technology Industry and Technology Construction	10350
400 to 480	Four	Exploring Technology Industry and Technology Construction Manufacturing	13850

*Industrial Arts Enrollment equals 25% of Projected School Enrollment at the Middle or Junior High School Level. (Data taken from Virginia Surveys).

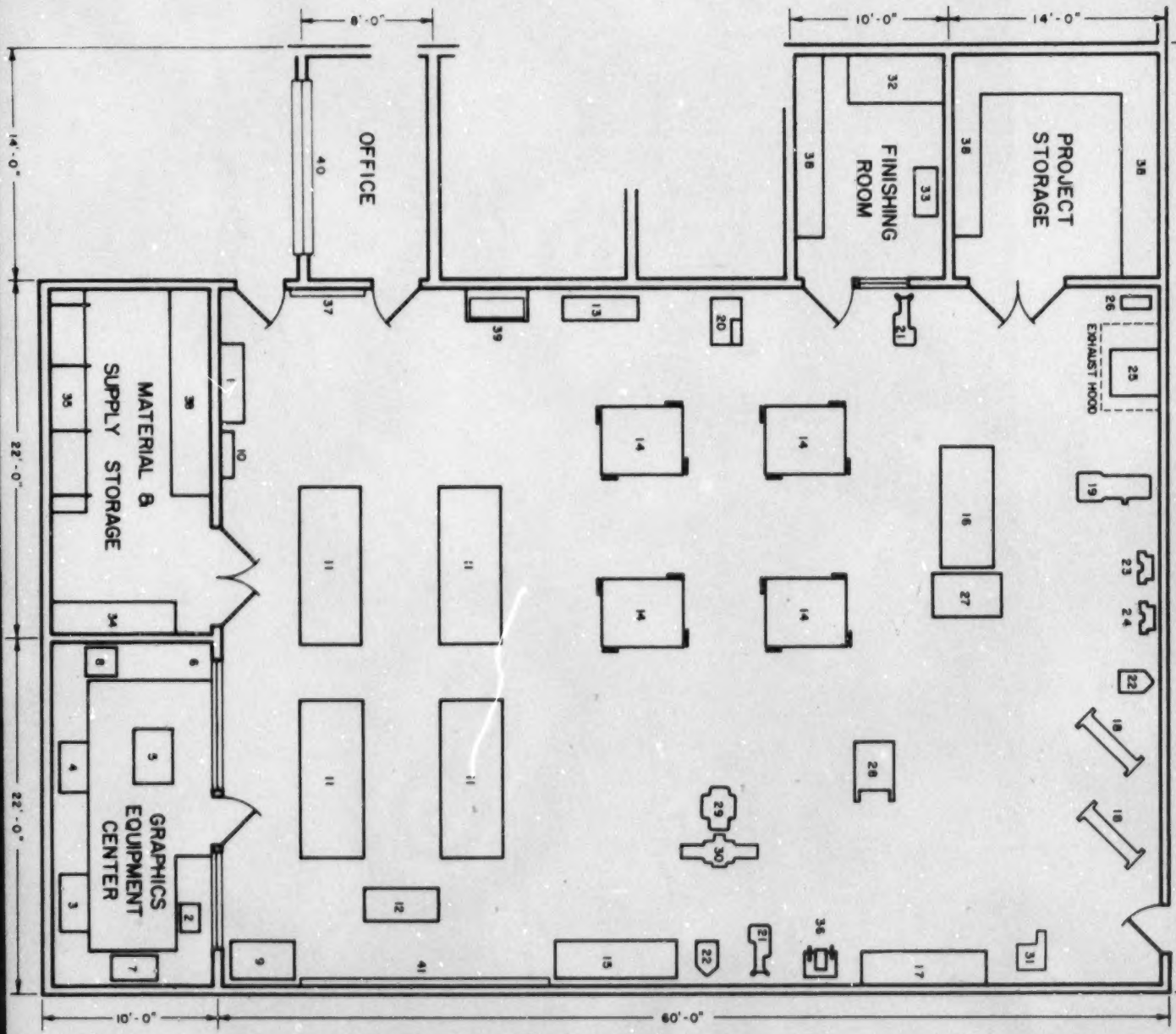
TABLE 2

MIDDLE OR JUNIOR HIGH SCHOOL
INDUSTRIAL ARTS LABORATORY
SPACE NEEDS
(SQ. FT.)

LABORATORY	INSTRUCTIONAL AREA	STORAGE MATERIAL	STORAGE PROJECT	EQUIPMENT	TEACHER'S OFFICE	AUXILIARY ROOMS	TOTAL
General	2650	200	200	200	100	Finishing 150	3500
Exploring Technology	2650	200	200	200	100	Finishing 150	3500
Industry & Technology	2650	200	200	200	100	Finishing 150	3500
Construction	2650	200	200	200	100		3350
Manufacturing	2650	200	200	200	100	Finishing 150	3500

22

21



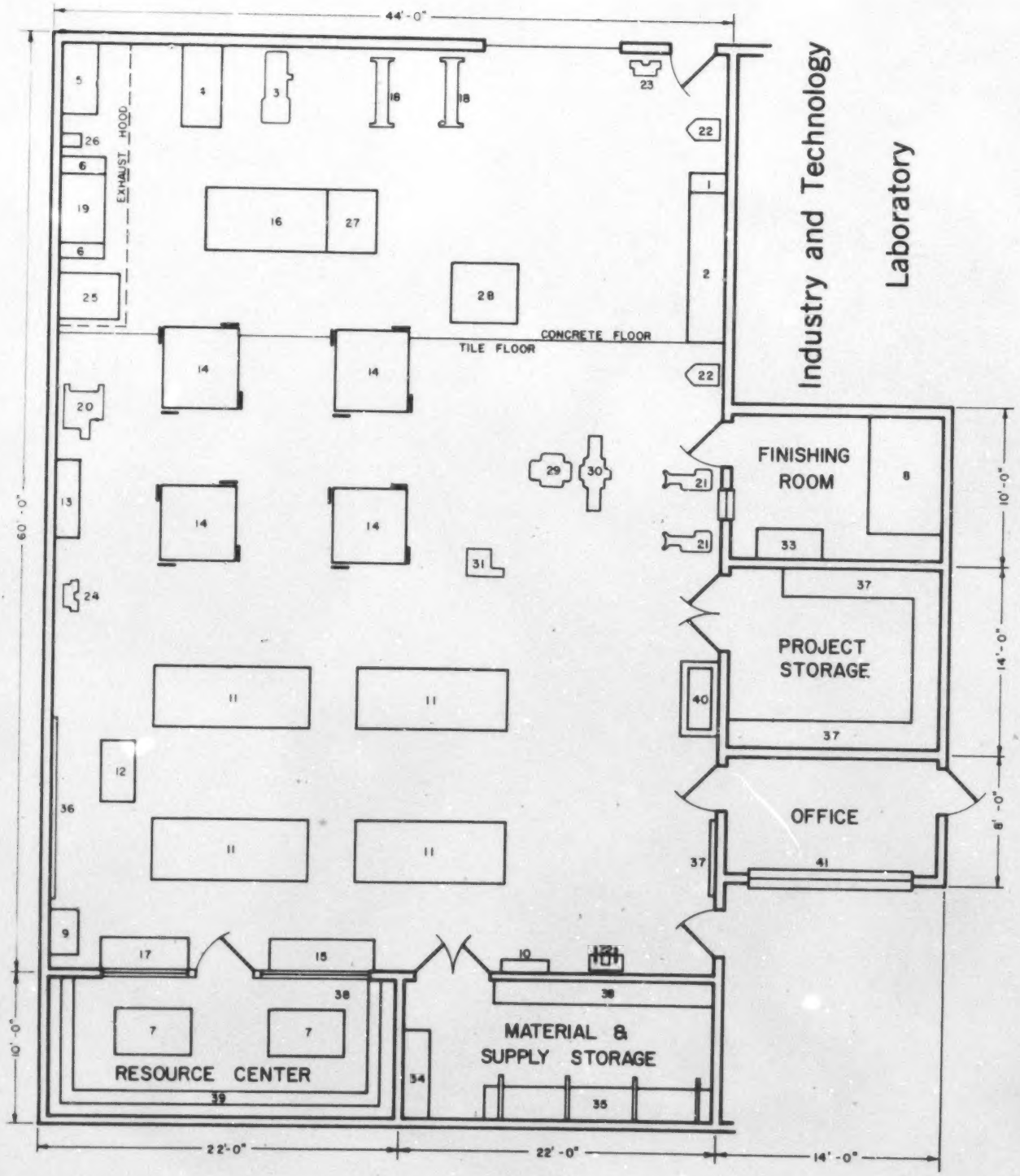
Exploring Technology Laboratory

RECOMMENDED EQUIPMENT LIST

FOR

EXPLORING TECHNOLOGY LABORATORY

No.	Description
1	E/E Experiment Module Storage Cabinet
2	Typewriter
3	Stripprinter
4	Platemaker
5	Offset Printing Press
6	Silk Screen Printing
7	Paper Cutter
8	Industrial Multi-Purpose Camera
9	Drafting Equipment Storage Cabinet
10	Safety Glasses Sanitizing Cabinet
11	Instructional Tables
12	Demonstration Bench
13	Tool Cabinet - General Tool Storage
14	Work Bench 4 Station w/Vises and Locker Storage
15	Plastics Work Center Accommodating Injection Molding, Vacuum Former, Strip Heater & Oven
16	Sheet Metal Bench
17	Wall Bench w/Storage Lockers
18	Wood Lathe
19	Lathe/Miller
20	Band Saw 14"
21	Scroll Saw
22	Drill Press
23	Standard Pedestal Grinder
24	Tool Sharpening Grinder
25	Welding Bench Gas/Arc
26	Spot Welder
27	Squaring Shear
28	Table Saw 10"
29	Surfacer 16"
30	Jointer 6"
31	Belt & Disc Sander
32	Finishing Table
33	Paint Storage Cabinet
34	Plywood Storage
35	Lumber Rack
36	Buffer
37	Tackboard
38	Shelving
39	Sink
40	Display Case
41	Chalkboard

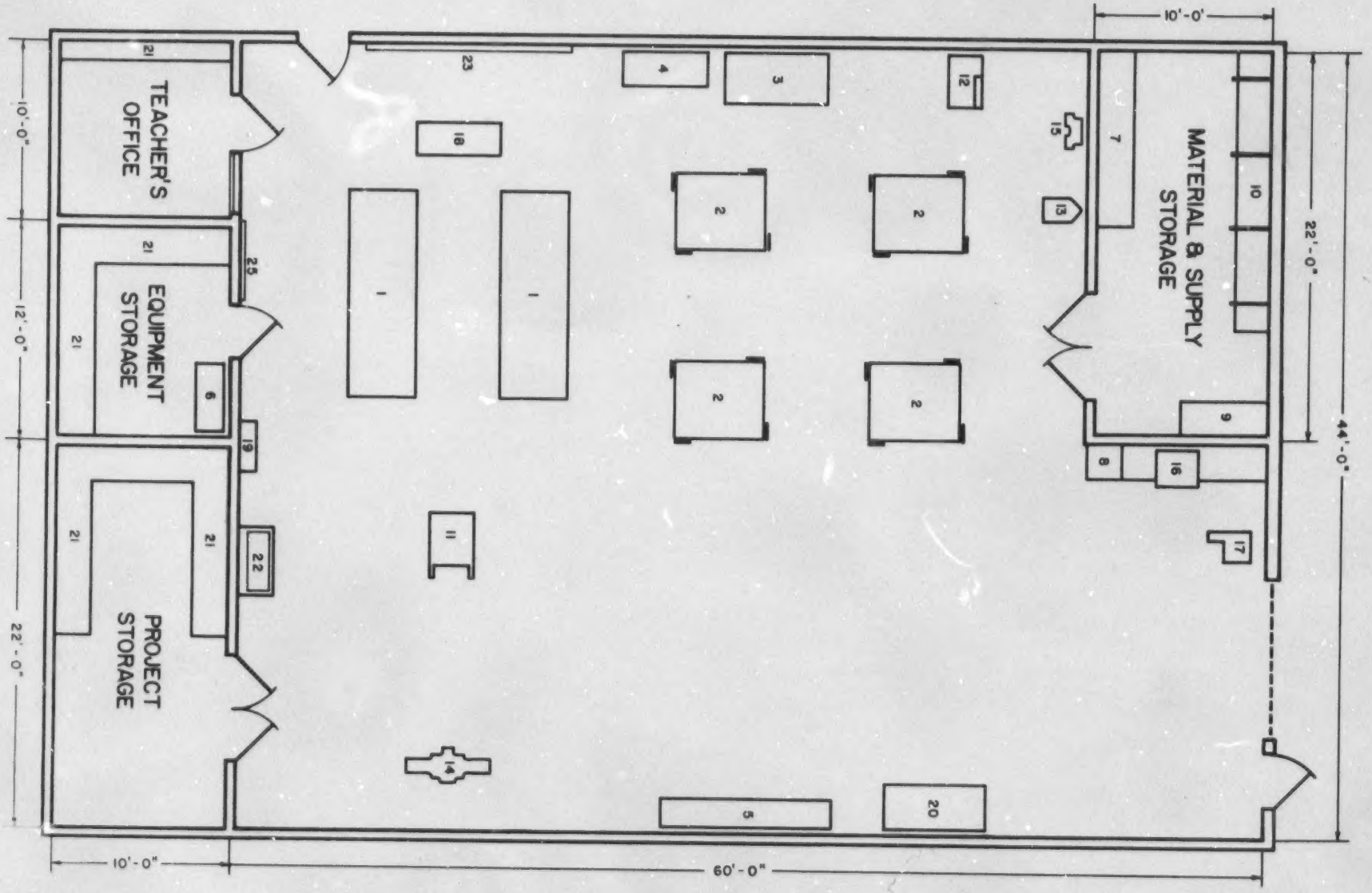

Industry and Technology Laboratory
44'-0"
60'-0"
EXHAUST HOOD
CONCRETE FLOOR
TILE FLOOR
FINISHING ROOM
PROJECT STORAGE
OFFICE
RESOURCE CENTER
MATERIAL & SUPPLY STORAGE
10'-0"
14'-0"
8'-0"
10'-0"
22'-0"
22'-0"
14'-0"

RECOMMENDED EQUIPMENT LIST

FOR

INDUSTRY AND TECHNOLOGY LABORATORY

No.	Description
1	Analyzer, Small Gas Engines
2	Power Mechanics Work Center Accommodating 4 Small Gas Engines, Tool Kits & Parts Storage
3	Metal Lathe 10"
4	Foundry Molding Bench
5	Heat Treating & Crucible Furnace Comb.
6	Bench Furnace
7	Conference Table
8	Spray Booth
9	Drafting Equipment Storage Cabinet
10	Safety Glasses Sanitizing Cabinet
11	Instructional Tables
12	Demonstration Bench
13	Tool Cabinet - General Tool Storage
14	Work Bench 4 Station w/Vises and Locker Storage
15	Plastics Work Center Accommodating Blow Molding, Injection Molding, Strip Heater & Vacuum Former
16	Sheet Metal Bench
17	Wall Bench w/Storage Lockers
18	Wood Lathe
19	Soldering Bench
20	Band Saw 14"
21	Scroll Saw
22	Drill Press
23	Standard Pedestal Grinder
24	Tool Sharpening Grinder
25	Welding Bench
26	Spot Welder
27	Squaring Shear
28	Table Saw 10"
29	Surfacer 16"
30	Jointer 6"
31	Belt & Disc Sander
32	Buffer
33	Paint Storage Cabinet
34	Plywood Storage
35	Lumber Rack
36	Chalkboard
37	Tackboard
38	Shelves
39	Storage Cabinets
40	Sink
41	Display Case



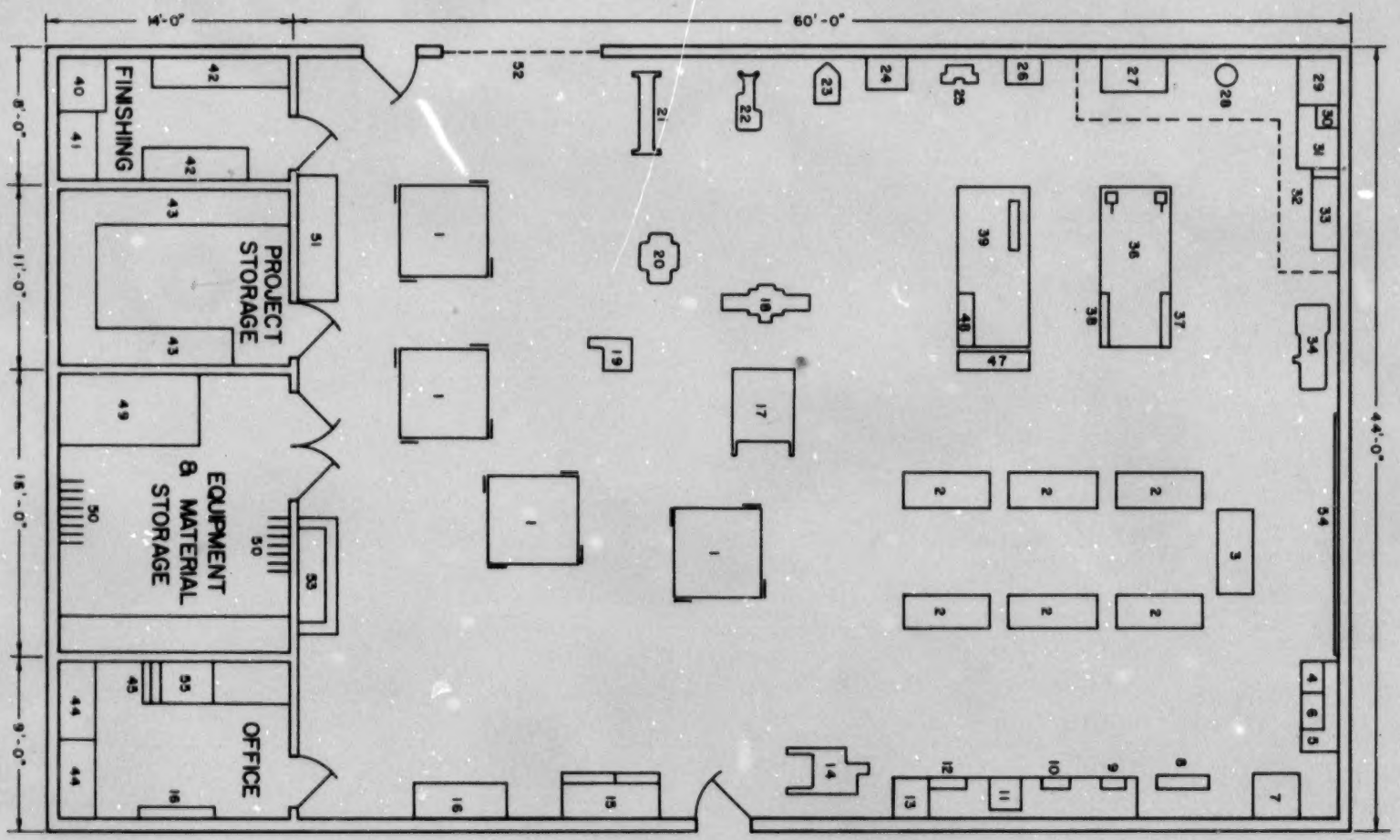
Construction Laboratory

RECOMMENDED EQUIPMENT LIST

FOR

CONSTRUCTION LABORATORY

No.	Description
1	Instructional Table
2	Work Bench 4 Station w/Vises and Locker Storage
3	Tool Cabinet Const. Tool Storage
4	Hardware Cabinet
5	Wall Bench w/Storage Drawers & Cabinet
6	Paint Storage Cabinet
7	Metal Storage Rack
8	Nail Ben
9	Plywood Storage Rack
10	Lumber Storage Rack
11	Table Saw 10"
12	Band Saw 14"
13	Drill Press
14	Jointer 6"
15	Pedestal Grinder
16	Miter Box Saw
17	Belt & Disc Sander
18	Demonstration Bench
19	Safety Glasses Sanitizing Cabinet
20	Tool & Equipment Storage Cabinet
21	Shelving
22	Sink
23	Bulletin Board
24	Overhead Door



Manufacturing Laboratory

RECOMMENDED EQUIPMENT LIST

FOR

MANUFACTURING LABORATORY

No.	Description
1	Wood Top Work Benches 54" x 64" 33 1/4
2	Wood Top Work Benches 6'x30"x30"
3	Instructors Mobil Demonstration Bench 24" x 48"
4	Mimeograph & Spirit Duplicator
5	Planning Table 42"x60"x29
6	Typewriter
7	Pilot Press
8	Injection Blow Molder
9	Injection Molder
10	Buffer/Polisher
11	Plastics Oven
12	Plastic Strip Heater
13	Vacuum Former
14	Bandsaw 14"
15	Tool Cabinet - General Shop
16	Safety Glass Cabinet
17	Circular Saw 10" tilting arbor
18	Jointer 6"
19	Disc & Belt Sander
20	Planer 16"
21	Wood Lathe
22	Scroll Saw 24"
23	Drill Press 15"
24	Sand Blaster
25	Pedestal Grinder 10"
26	Heat Treating Furnace
27	Foundry Molding Bench
28	Crucible Furnace
29	Welding Bench (Arc)
30	Welding Bench (Gas)
31	Welder, Electric arc, Gas welding & cutting
32	Soldering Furnace
33	Soldering Bench 5' x 30"
34	Metal Lathe 10"
35	Metal Bench 96" x 40" x 2"
36	Slip Rolls
37	Box & Pan Brake
38	Metal Bench 96" x 40" x 2"
39	Spray Booth
40	Paint Safety Cabinet
41	Shelving
42	Storage Cabinets
43	File Cabinets
44	Dust Collector System
45	Foot Squaring Shears 36"
46	Bar Folder 24"
47	Storage Rack - Plywood
48	Lumber & Metal Storage Rack
49	Glue & Stain Bench
50	Overhead Door
51	Sink
52	Chalk Board
53	Desk

HIGH SCHOOL GRADES 9-12

DESCRIPTION

Industrial Arts in the high school provides a foundation for career preparation either at the secondary or post secondary level and/or a personal technical development which prepares the individual for living in a technical and industrial society. The high school program complements the middle or junior high school while neither duplicating nor repeating previous courses. Emphasis at the high school is upon:

- Preparing for enrollment in advanced technical programs or;
- Developing technical competencies that result in responsible citizenship, intelligent product selection and use, and worthy use of leisure time.

GOAL

I. Pretechnical

To prepare students for advanced vocational and technical education programs.

STANDARDS

To accomplish this purpose the high school pre-technical program shall provide:

1. Exploring Industrial Practices
   Experiences in laboratories which develop individual skill and creative abilities in the proper use of industrial tools, machines, materials, processes and products.

2. Preparation for Advanced Training
   Experiences and instruction in laboratories which will prepare individuals for entry into advanced occupational or technical education programs.

3. Occupational Information
   Occupational information, observations and instruction which will assist individuals to discover and develop talents, interest, attitudes and potential related to industry and technology.

STANDARDS

4. Guidance and Counseling
Guidance and counseling for students to assist them in making informed and meaningful choices in selected occupational fields.

5. Approved Courses
Approved courses include:
Communications Technology
Power and Transportation Technology
Materials and Processes Technology

6. Grade Level
High school level, grades 9-12, excluding junior high school.

7. Teacher Qualifications
Teacher shall hold endorsement in Industrial Arts and have collegiate preparation through in-service or pre-service to implement the specific course assigned.

8. Student-Teacher Ratio
Class enrollment should not exceed 20 students per period per teacher.

9. Equipment
Laboratory equipment shall provide for activities appropriate to the course offered.

10. Materials and Supplies
Instructional materials and supplies shall be provided to accommodate each student's needs within the context of the course enrolled.

11. Facilities
Instructional laboratory shall adequately accomodate all students enrolled. (see tables 3 and 4).

TABLE 3

SENIOR HIGH SCHOOL
INDUSTRIAL ARTS LABORATORIES SUGGESTED*

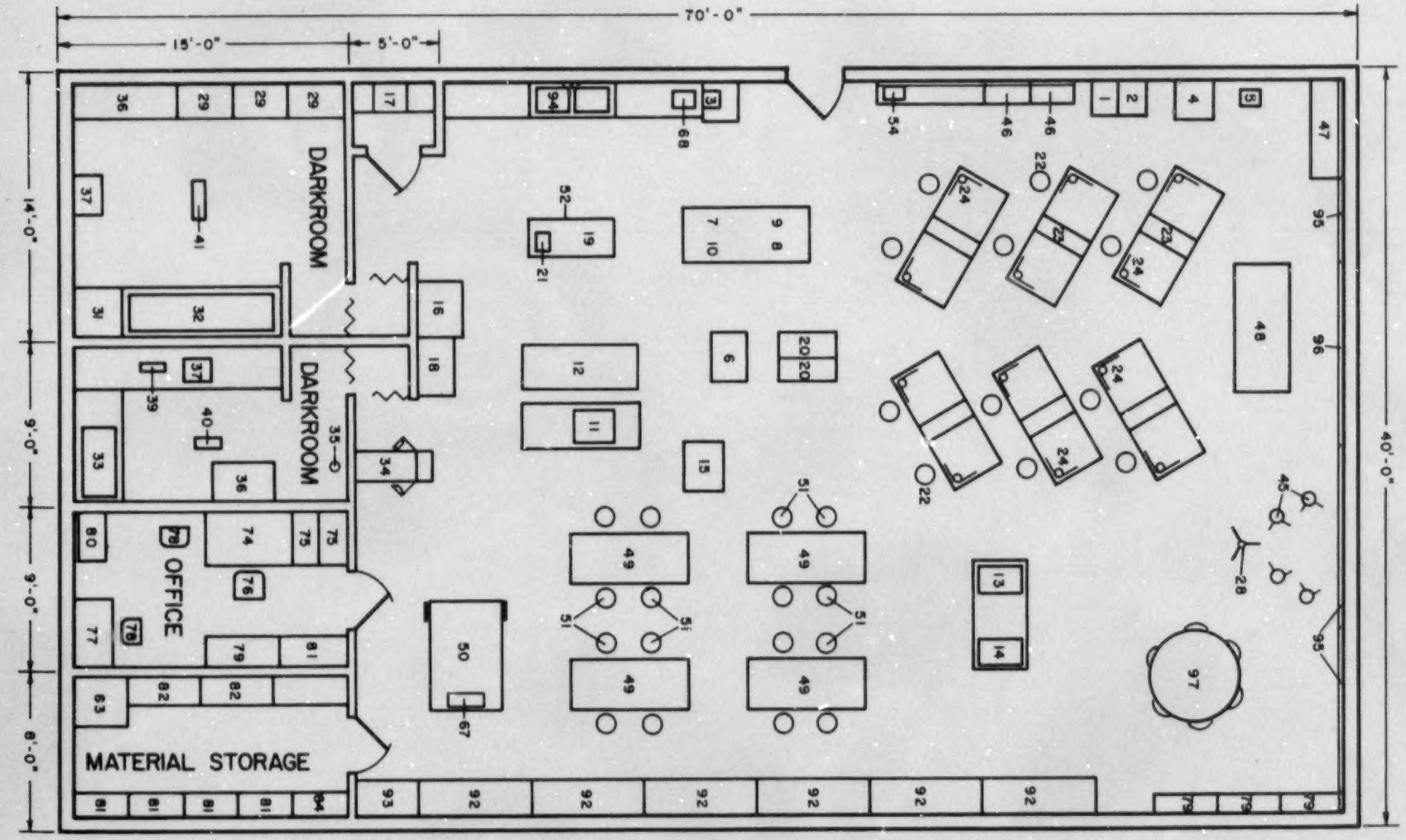
INDUSTRIAL ARTS ENROLLMENT*	NUMBER OF LABS	EXAMPLES OF LABORATORIES NEEDED	TOTAL SPACE NEEDS SQ. FT.
To 120	One	General	3850
160 to 240	Two	Materials and Processes Mechanical Drawing	5650
280 to 360	Three	Materials and Processes Mechanical Drawing Communications	8450
400 to 480	Four	Materials and Processes Mechanical Drawing Communications Transportation	11250
520 to 600	Five	Materials and Processes Mechanical Drawing Communications Transportation Woodworking	15025
640 to 720	Six	Materials and Processes Mechanical Drawing Communications Transportation Woodworking Metalworking	18525

*Industrial Arts enrollment equals 22% of projected school enrollment at the Senior High School. Each Trade and Industrial Education program offered in the same school will reduce the Industrial Arts enrollment by approximately 7%. When four or more Trade and Industrial Programs are provided in the school the Industrial Arts department normally does not reduce to less than 15% of the school enrollment. (Data taken from Virginia Surveys).

TABLE 4

INDUSTRIAL ARTS LABORATORY
SPACE NEEDS
(SQ. FT.)

LABORATORY	INSTRUCTIONAL AREA	STORAGE MATERIAL	STORAGE PROJECT	EQUIPMENT	TEACHER'S OFFICE	AUXILIARY	ROOMS	TOTAL SPACE NEEDS
SENIOR HIGH SCHOOL (GR 9-12)								
General	3000	200	200	200	100	Finishing 150		3850
Materials and Processes	3000	200	200	200	100	Finishing 150		3850
Mechanical Drawing	1600	100			100			1800
Communications	2000	120	100	135	100	Photo Lab 210	Dark Rm. 135	2800
Power & Transportation	2400		200		100	Testing 100		2800
Woodworking	2650	250	200	150	100	Finishing 225	Adult Class Storage 200	3775
Metalworking	2650	200	250	150	100	Finishing 150		3500
Electricity/Electronics	1600	100			100	Testing 100		1900
Graphic Arts	2650	120	125	135	100	Photo Lab 220	Dark Rm. 150	3500



Communications Technology Laboratory

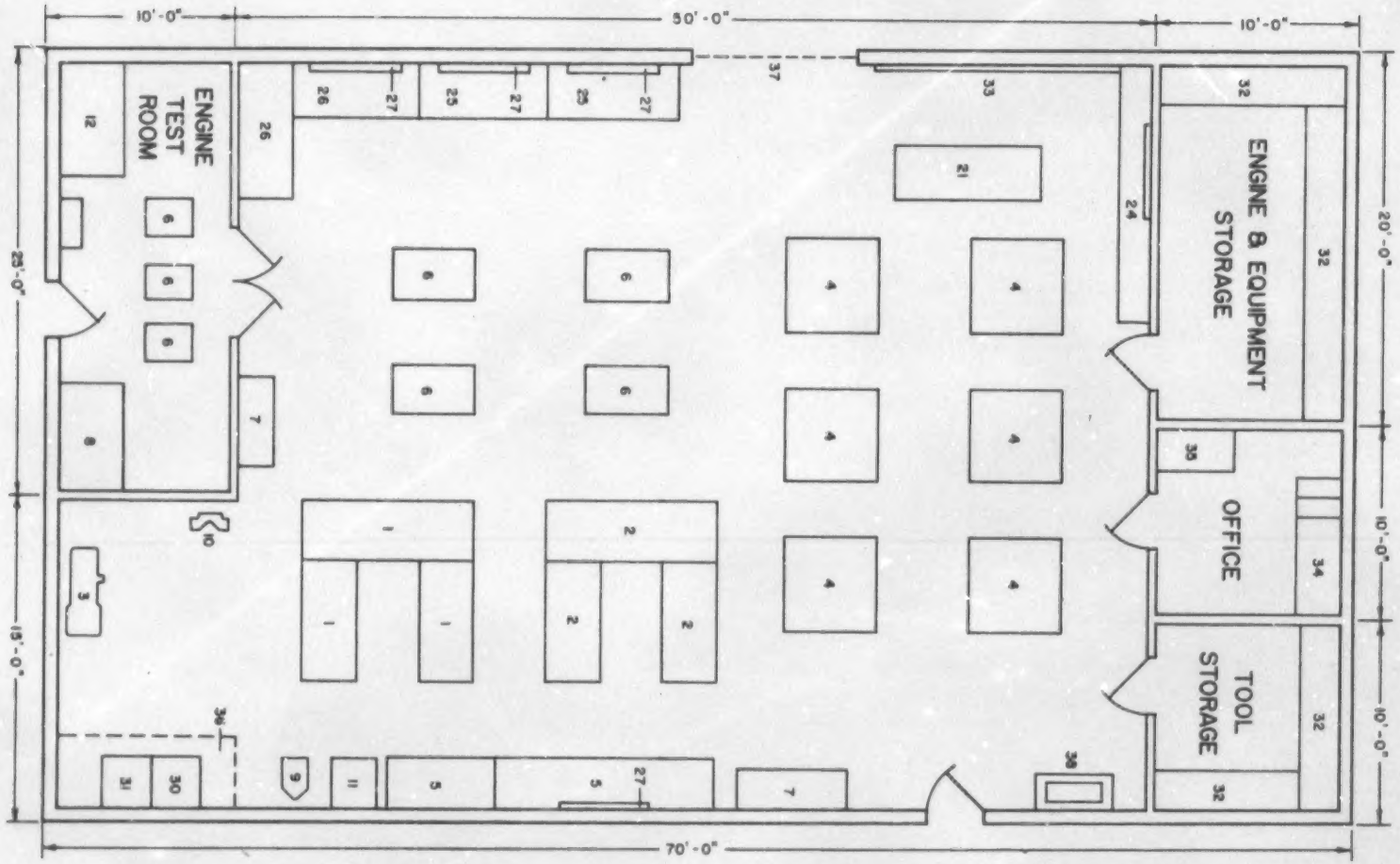
RECOMMENDED EQUIPMENT LIST

FOR

COMMUNICATIONS TECHNOLOGY LABORATORY

No.	Description	No.	Description
1	Pilot press	50	Work bench
2	Type cabinet	51	Stools
3	Rubber stamp press	52	Paper cabinet
4	Paper cutter	53	Leroy lettering outfit
5	Saddle stapler	54	Thermofax copier
6	Printmaker	55	Telecommunications trainers
7	Paper drill	56	Breadboard systems
8	Jogger	57	Power supply, D.C. low voltage
9	Folder	58	Volt-ohm meters
10	Collator	59	General purpose 3" oscilloscope, 1.5 MHZ
*11	Offset press (table top)	60	Signal generator, RF
*12	Offset press (floor model)	61	Signal generator, AF
13	Mimeo Duplicator	62	Transistor testor
14	Spirit Duplicator	63	Capacitor testor
15	Drying rack	64	Digital volt meter
*16	Platemaker	65	Soldering pencils
17	Strip printer	66	Assorted hand tools
18	Plate finishing table	67	Printed circuit board shear with accessories
19	Electrostatic printmaker	68	Drymount press
20	Light tables	69	Movie camera-Super 8
21	Master conversion unit	70	Film editor/viewer
22	Drafting stools	71	Movie projector-Super 8
23	2 Station drafting tables	72	Daylight developing tank
24	Drafting machines	73	Temperature control valves
25	35mm Camera (Range Finder)	74	Double pedestal desk
26	35mm SLR camera	75	File cabinet - 4 drawer letter size
27	Light meters	76	Chair-instructor's swivel
28	Tripod	77	Work table
29	Enlarger	78	Chair, side
30	Easels	79	Bookcase
31	Print washer 18"	80	Film storage refrigerator
32	Sink, developing	81	Storage cabinet
33	Sink, litho	82	Shelving unit
*34	Process camera	83	Shelving-paper storage
35	Point light source lamp	84	Safety cabinet
36	Film storage cabinet	85	Safety glass cabinet, with glasses/goggles
37	Film dryer	86	Safety cans
38	Timer (enlarger)	87	Plunger cans (1 quart)
39	Timer	88	Oily waste cans
40	Safelights (litho room)	89	Bindery truck
41	Safelights (enlarger)	90	Screen printing frames
42	Developing trays	91	Drafting equipment set
43	Developing tanks	92	Electronics Bench w/instrument shelf
44	Reels	93	Drill Press - Bench Model
45	Photo Flood light	93	Drill Press - Bench Model
46	Electric typewriters	94	Sink
47	White printer	95	Tack Board
48	Instructor's table	96	Chalk Board
49	Work tables (plastic laminate top)	97	Library Table

*NOTE: Press, Platemaker and Process Camera should be of compatible size.



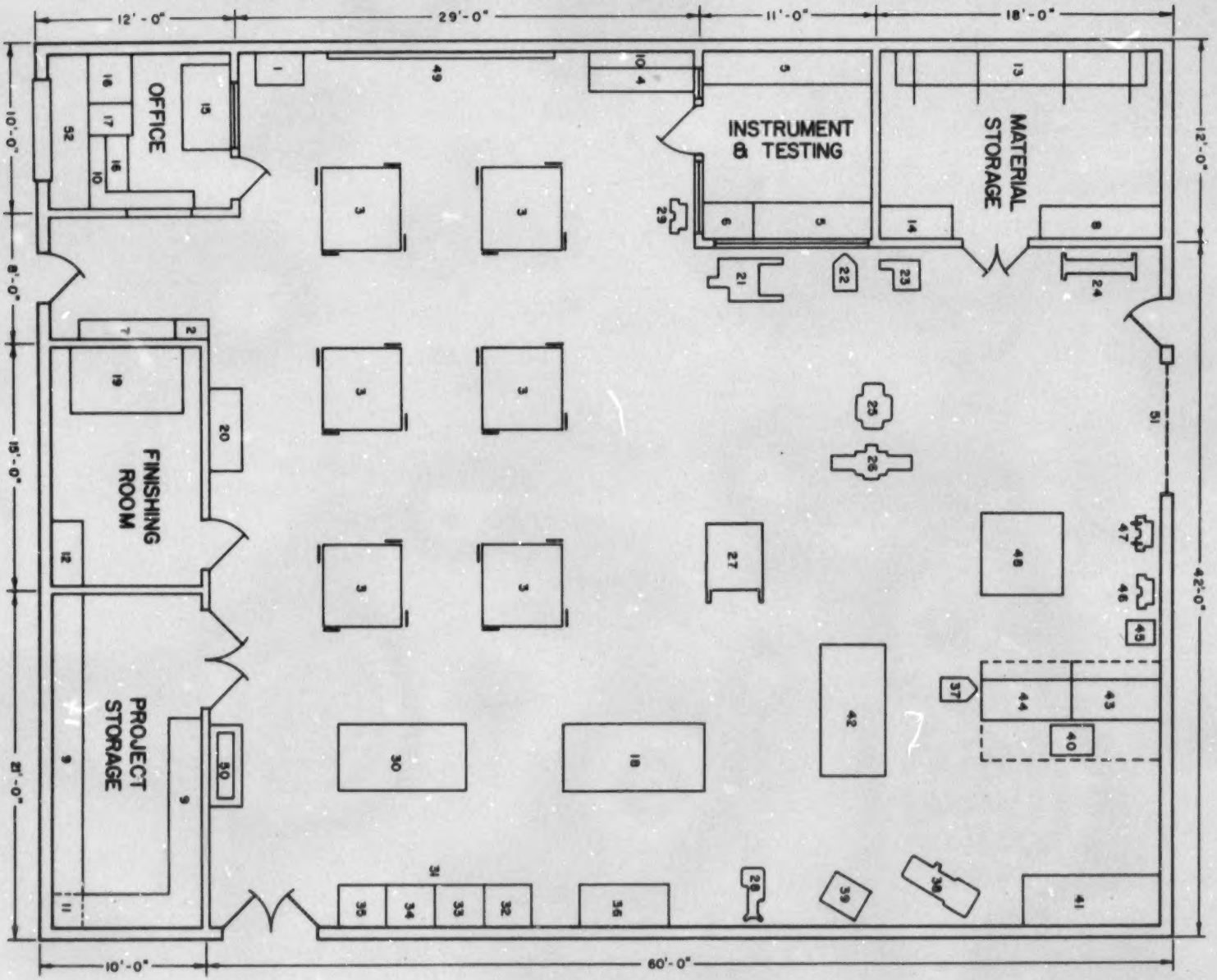
Power and Transportation Technology Laboratory

RECOMMENDED EQUIPMENT LIST

FOR

POWER AND TRANSPORTATION TECHNOLOGY LABORATORY

No.	Description
1	Hydraulic Trainers [could be
2	Pneumatic Trainers [combined trainers
3	Lathe (12")
4	Work Benches (Wood top)
5	Work Benches (Metal top)
6	Engine Test Stands (Large)
7	Parts Washer
8	Outboard Test Tank
9	Drill Press (18" - 20")
10	Pedestal Grinder
11	Arbor Press
12	Small Engine Dynomometer
13	2-Cycle Internal Combustion Engines (Small)
14	4-Cycle Internal Combustion Engines (Small)
15	Diesel Engines
16	Rotary Engines
17	Outboard Engines
18	4 Cylinder Engine
19	6 Cylinder Engine
20	8 Cylinder Engine
21	Demonstration Bench
22	Small Engine Test Bench
23	Electric Motors (AC & DC)
24	Wiring Panel for Electric Motors
25	Mechanical Power Trainers
26	Electrical Power Trainers
27	Hand Tools
28	Exhaust System for All Engines
29	Test Equipment
30	Arc Welder
31	Acetylene Welding Outfit
32	Storage Shelves
33	Chalkboard
34	Desk
35	File Cabinet
36	Exhaust Hood
37	Overhead Door
38	Sink



Materials and Processes Laboratory

RECOMMENDED EQUIPMENT LIST

FOR

MATERIALS AND PROCESSES LABORATORY

No.	Description
1	Drafting Equipment Storage Cabinet
2	Safety Glasses Storage Cabinet
3	Workbench, Wood top, 4 station w/4 Woodworkers Vises and Metal Storage Locker Base
4	Wall Bench, Wood top w/Storage
5	Wall Bench, Perimeter, Wood Top w/Storage Lockers 30" x 30' (Total Perimeter)
6	Universal Testing Machine
7	Testing Equipment Storage Cabinet, Glass Front
8	Shelving 24" Material and Supply Storage
9	Shelving 24" Project Storage
10	Shelving 12" Book and Material Storage
11	Air Compressor
12	Cabinet, Paint and Finishing Supply Storage (Fire Proof)
13	Rack, Lumber Storage
14	Rack, Plywood Storage
15	Desk, Teacher's
16	Wardrobe Closet
17	File Cabinet 4 Drawer
18	Work Table 30" x 48"
19	Spram Booth, Complete w/Spray .
20	Woodworking Tool Storage Cabinet
21	Band Saw 20" Wood-Metal Cutting
22	Drill Press 15"
23	Belt and Disc Sander w/Built-in Dust Collector
24	Wood Lathe 12"
25	Surfacer 16"
26	Jointer 6"
27	Table Saw 10"
28	Scroll Saw 24"
29	Grinder Tool Sharpening (Slow Speed)
30	Glue Bench w/Clamp Storage
31	Wall Bench, Wood Top w/Storage Lockers 24" x 12'
32	Plastics Oven
33	Injection Molder
34	Rotational Molder
35	Vacuum Former
36	Metalworking Tool Storage Chest
37	Drill Press 15"
38	Metal Lathe 11"
39	Milling Machine Horizontal/Vertical Comb.
40	Furnace, Combination Heat Treating and melting
41	Bench, Foundry Modling
42	Sheet Metal Work Center w/Squaring Shears, Folder, Brake, Slip Rolls and Notcher Storage Below 24" 20 Gauge Capacity
43	Welder, arc complete w/Table
44	Welder, Gas complete w/Table and Cylinder Cart
45	Welder, Electric Spot
46	Grinder, Pedestal
47	Buffer, Pedestal
48	Work Bench, Steel Top w/4 Metalworkers Vises
49	Chalk Board
50	Sink
51	Overhead Door
52	Display Case

HIGH SCHOOL GRADES 9-12

GOAL

II. Personal Enrichment

To prepare students with consumer information, avocational skills and technical understanding.

STANDARDS

To accomplish this purpose the high school personal enrichment program shall provide:

1. Technical Experiences
   Laboratory experiences and observations in industry to acquaint students with technology and the major areas of its impact on people and their everyday living.

2. Consumer Information
   Consumer information and instruction enabling students to purchase, care for and use products.

3. Avocational Information
   Avocational information and basic skills to pursue a hobby or avocation for the productive use of leisure time.

4. Approved Courses
   Approved courses include:
   - Mechanical Drawing
   - Electricity/Electronics
   - Graphic Arts
   - General Industrial Arts
   - Industrial Crafts
   - Metalworking
   - Woodworking
   - Power Mechanics

5. Grade Level
   High school level grades 9-12.

6. Teacher Qualifications
   Teacher shall hold endorsement in Industrial Arts.

7. Student-Teacher Ratio
   Class enrollment should not exceed 20 students per period per teacher.

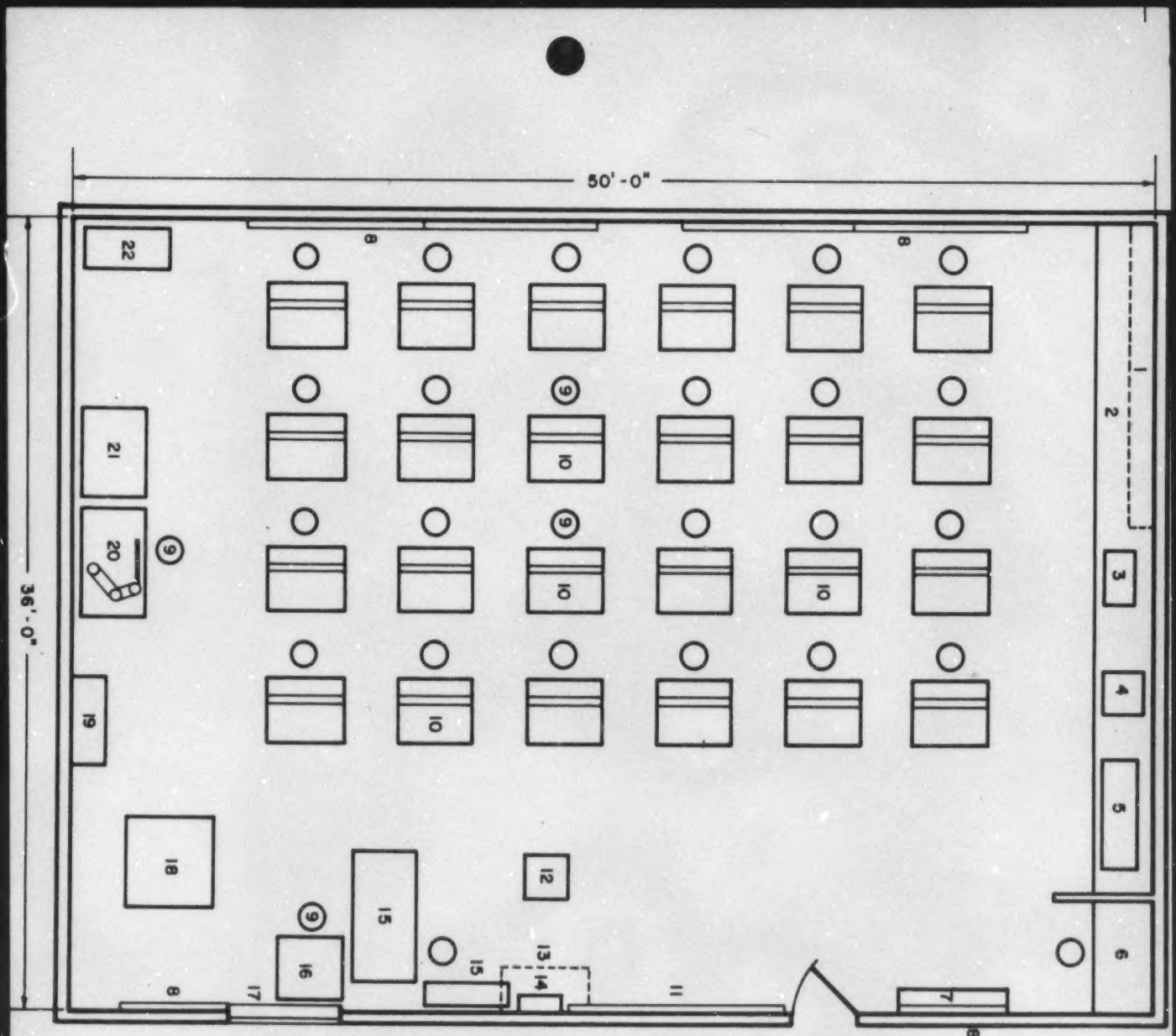
HIGH SCHOOL GRADES 9-12

STANDARDS

8. Equipment
Laboratory equipment shall provide for activities appropriate to the course offered.

9. Materials and Supplies
Instructional materials and supplies shall be provided to accommodate each student's interests within the context of the course enrolled.

10. Facilities
Instructional laboratory shall adequately accommodate all students enrolled. (see tables 3 and 4).



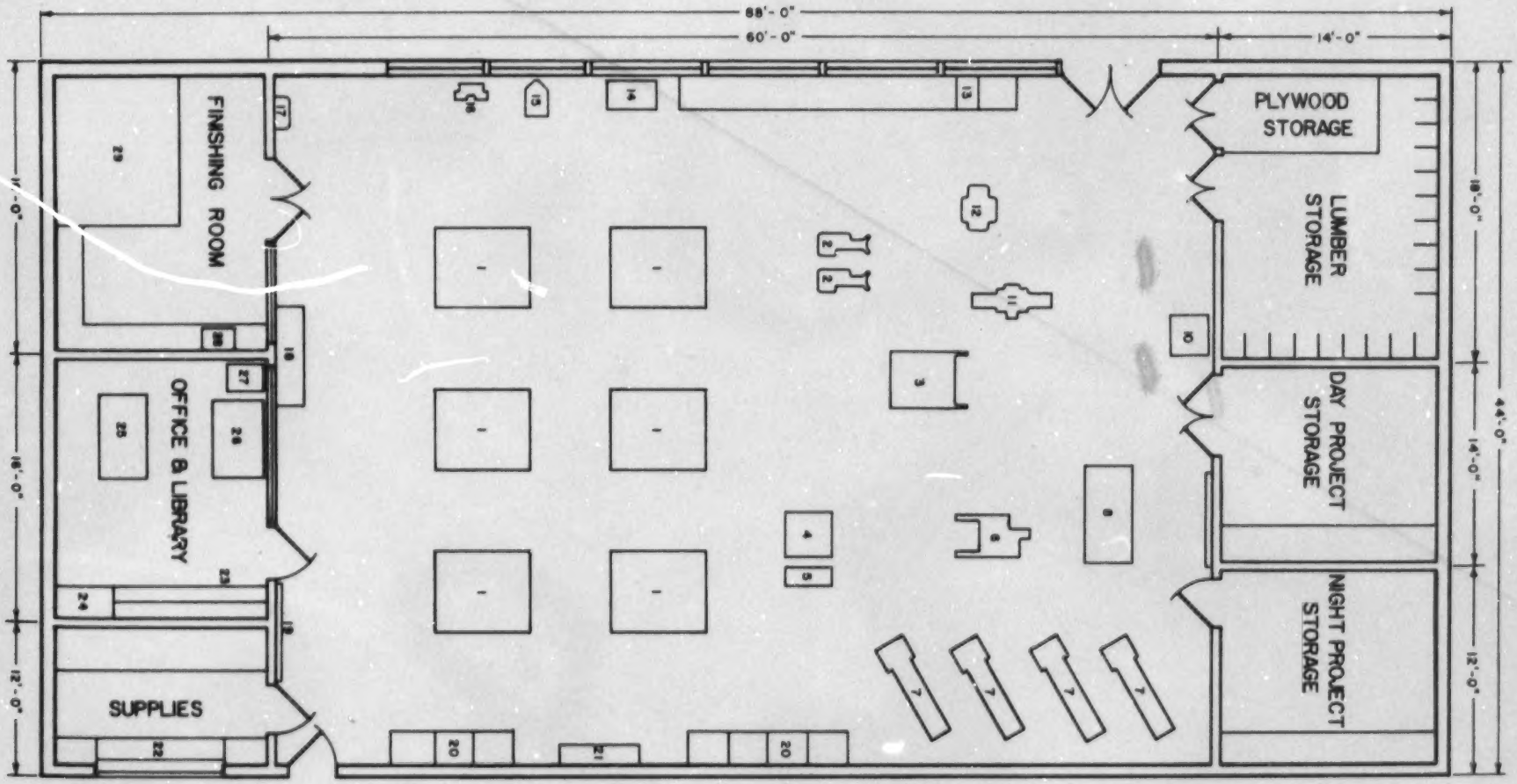
Mechanical Drawing Classroom

RECOMMENDED EQUIPMENT LIST

FOR

MECHANICAL DRAWING CLASSROOM

No.	Description
1	Over-head Cabinet
2	30" Counter with Cabinet Below
3	Sink
4	Paper Cutter
5	Printer
6	Study Carrell with Varagraph and Dart Projector
7	Bookcase
8	Bulletin Board
9	Stool
10	Drafting Desk with Parallel Ruling Edge
11	Chalk board
12	Over-head Projector
13	Over-head Screen
14	Key Cabinet
15	Bruning Instructor's Resource Center
16	Light Table
17	Display Window
18	Model Building Table
19	Tool & Storage Cabinet for Models
20	Large Drafting Table with Drafting Machine
21	Flat File Cabinet
22	Storage Cabinet



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Woodworking Laboratory

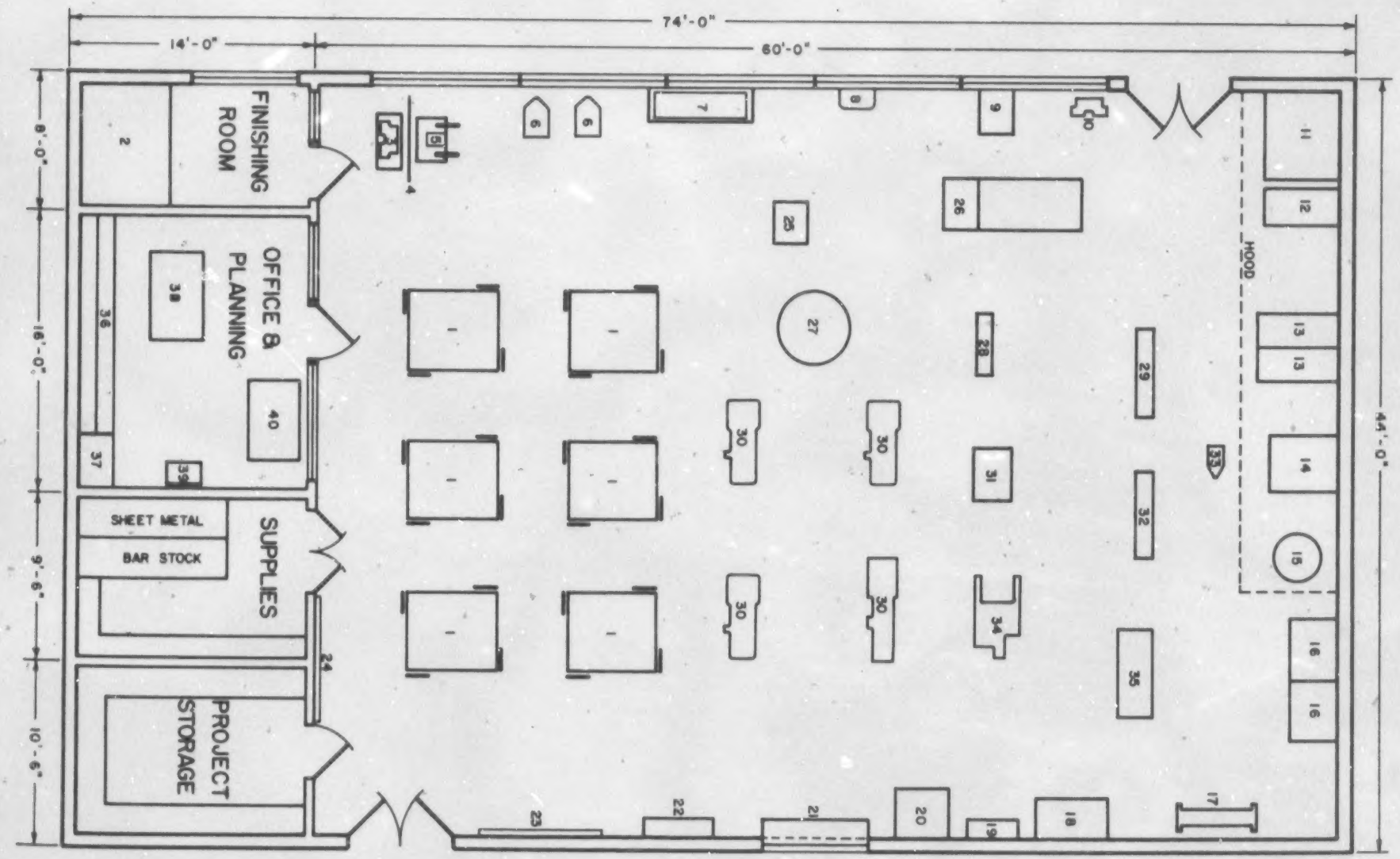
51

RECOMMENDED EQUIPMENT LIST

FOR

WOODWORKING LABORATORY

No.	Description
1	Wood Top Work Benches
2	Scroll Saw
3	Circular Saw
4	Spindle Sander
5	Disc Sander
6	Band Saw
7	Wood Lathe
8	Glue Bench
9	Clamp Rack
10	Shaper
11	Jointer
12	Surfacer
13	Radial Arm Saw (Cut Off Saw)
14	Mortiser
15	Drill Press
16	Grinder
17	Drinking Fountain
18	Wash Sink
19	Chalkboard
20	Lockers
21	Tool Panel
22	Display Case
23	Bookshelve
24	Closet
25	Table
26	Desk
27	File Cabinet
28	Sink
29	Spray Booth



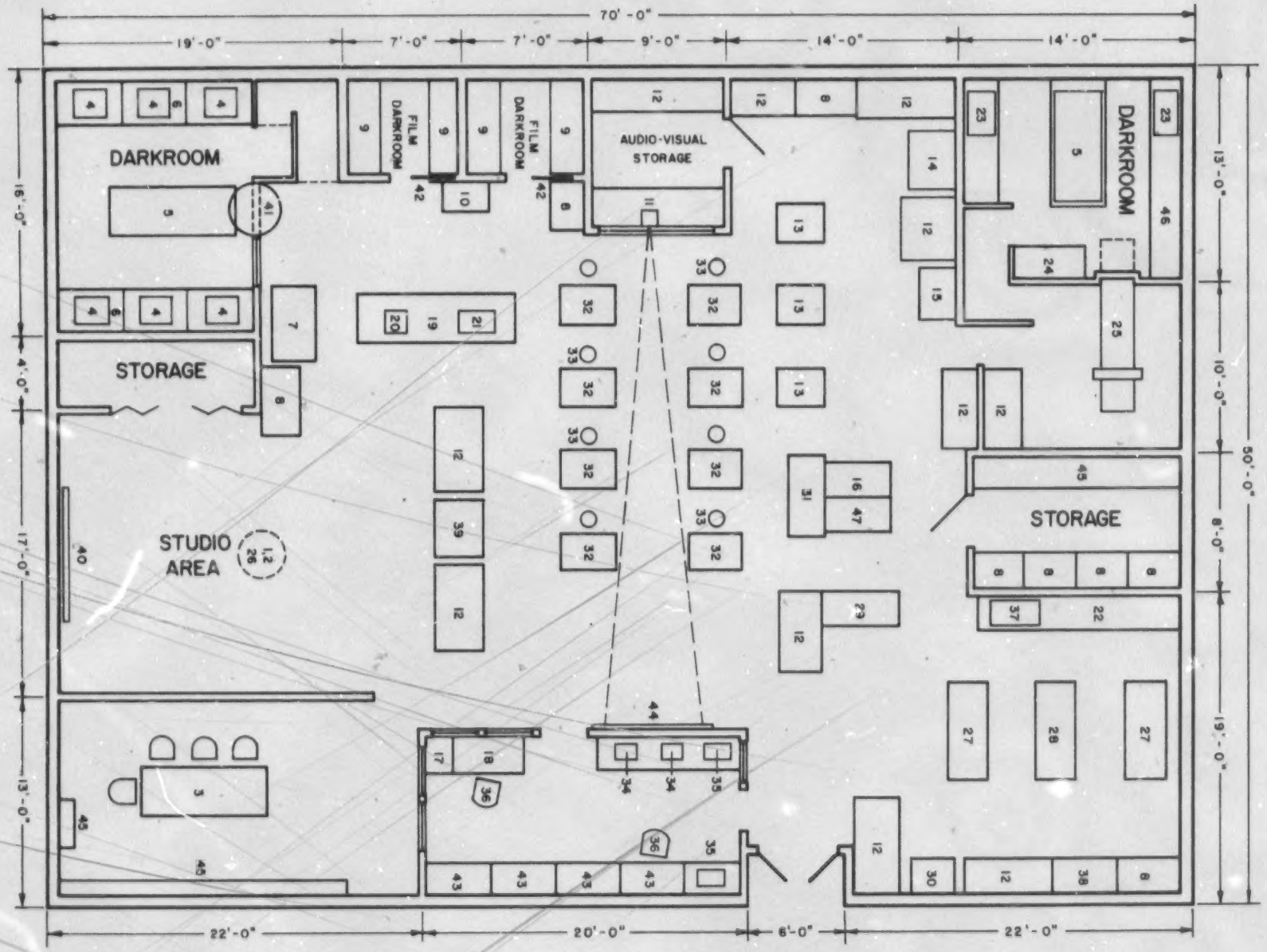
53 **Metalworking Laboratory** 54

RECOMMENDED EQUIPMENT LIST

FOR

METALWORKING LABORATORY

No.	Description
1	Metal Working Bench
2	Spray Booth
3	Grinder
4	Shield
5	Buffer
6	Drill Press
7	Wash Sink
8	Drinking Fountain
9	Spot Welder
10	Tool Grinder
11	Arc Welder
12	Gas Welding
13	Soldering Bench
14	Forge
15	Crucible Furnace
16	Molding Bench
17	Spinning Lathe
18	Surface Grinder
19	Cabinet
20	Mill
21	Display
22	Tool Panel
23	Chalkboard
24	Tackboard
25	Hack Saw
26	Shear
27	Hand Machines
28	Hydraulic Press
29	Stakes
30	Lathe
31	Shaper
32	Folder Roll
33	Anvil
34	Metal Cutting Band Saw
35	Brake
36	Bookshelves
37	Closet
38	Table
39	File Cabinet
40	Desk



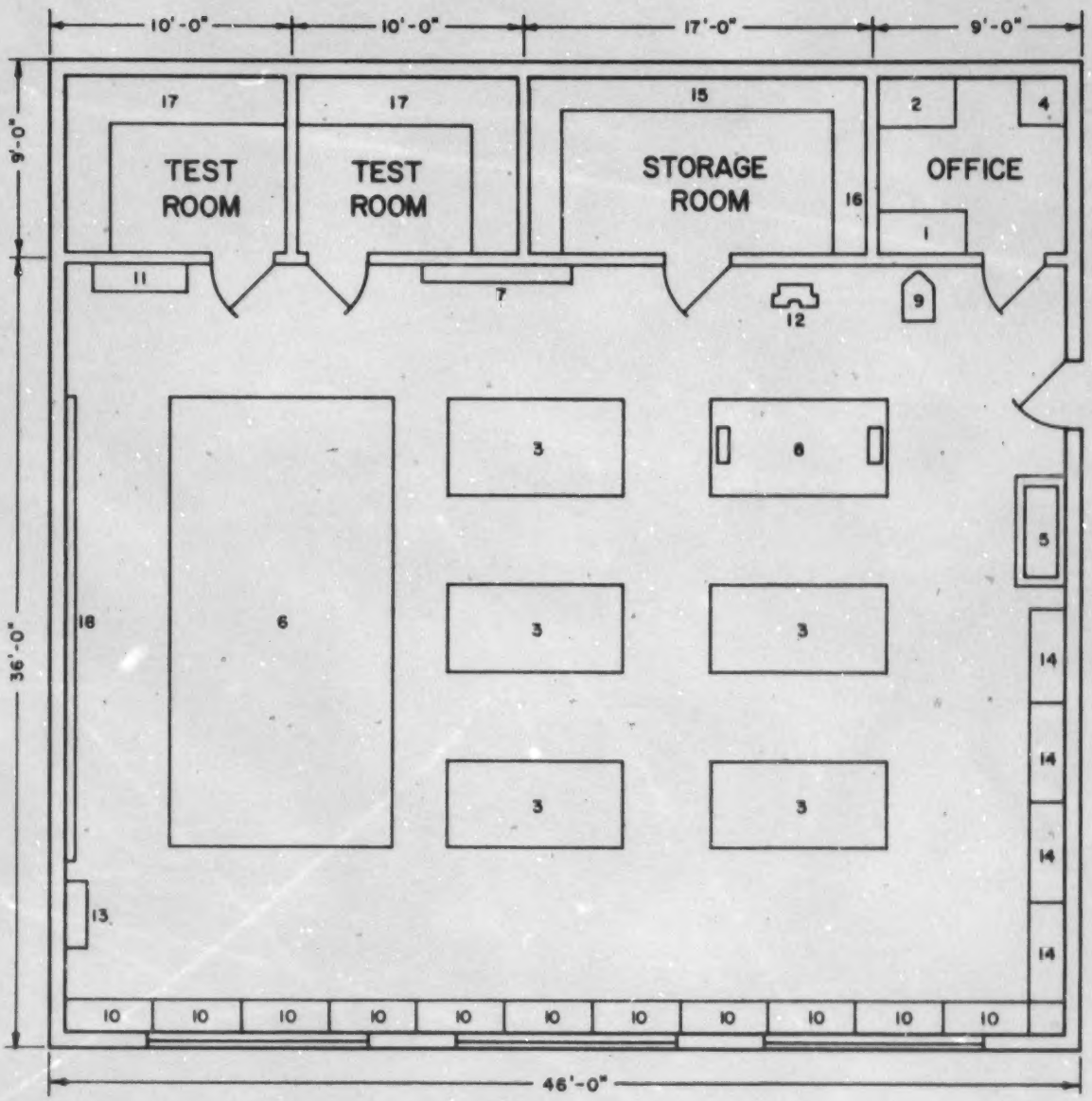
Graphic Arts Laboratory

RECOMMENDED EQUIPMENT LIST

FOR

GRAPHIC ARTS LABORATORY

No.	Description
1	Polaroid Cameras & Tripod
2	35 mm Cameras & Tripod
3	Study Table w/ 4 Chairs
4	Enlarger Black and White
5	Two-Sided Sink
6	Enlarger Bench
7	Print Drying Rack
8	Storage Cabinet
9	Film Loading Bench
10	Film Dryer, Hand Camera
11	Film Projector, 16 mm
12	Work Table
13	Light Tables, Layout
14	Flip Top Plate Maker, Litho
15	Plate Sink, Litho
16	Type Cabinets and Bank
17	File Cabinet, Office
18	Desk, Office
19	Finishing Counter
20	Paper Cutter Hand Trim
21	Paper Folder, 11" x 17"
22	Silk Screen Frames
23	Vacuum Contact Frame
24	Film Bench
25	18" x 22 Process Camera, Litho
26	Polaroid Industrial View Camera
27	1250 Offset, Printing Press or Equal
28	360 Offset, Printing Press or Equal
29	11 x 17 Offset Printing Press A-M Equal
30	Paper Cutter 18" x 22" Challenge
31	Platen Press 11" x 17"
32	Drawing Table
33	Stool
34	IBM Auto Typewriter, with Multi Face
35	Photo Display Typewriter, Composition
36	Desk Chair
37	Silk Screen Press 18" x 22" max.
38	Screen Drying Rack 18" x 22" max.
39	Silk Screening Table
40	Roll Paper Backgrounds
41	Pass Through Washer
42	Sliding Door
43	Study Carrel
44	Projector Screen
45	Shelves
46	Work Counter
47	Proof Press



Electronics Laboratory

RECOMMENDED EQUIPMENT LIST

FOR

ELECTRONICS LABORATORY

No.	Description
1	Teacher's Wardrobe
2	Teacher's Desk
3	Work Tables, 4' x 8', w/110V Power Strip on One End
4	File Cabinet
5	Trough Sink
6	Student's Desk for Lecture Area
7	Bookcase
8	Sheet Metal Bench
9	Drill Press
10	Work Bench with 40' of 110V Power Strip and AM Antenna Leads Every 5'
11	Reference Book Shelves
12	Grinder
13	Storage Shelves for Manuals
14	Test Equipment Cabinets
15	Storage Shelves
16	Small Parts Storage
17	Work Counter

ARCHITECTURAL

CONSIDERATIONS

ARCHITECTURAL CONSIDERATIONS FOR INDUSTRIAL ARTS FACILITIES

A. LOCATION AND HOUSING

1. The site area devoted to Industrial Arts facilities should be adjacent to or connected with the other areas used for education purposes and easily accessible by vehicles. An adequate parking area should be provided.

2. The site area devoted to Industrial Arts facilities should be large enough to provide for future expansion.

3. Industrial Arts facilities should be located so that they are easily accessible for evening school use.

4. Laboratories in which noisy activities are conducted should be isolated by location or construction from other activities that might be disturbed or which might disturb class work.

5. Industrial Arts facilities should be clustered in one or more buildings or in a section of a school building planned and designed for Industrial Arts activities.

6. Industrial Arts laboratories should be on the ground floor.

7. Where facilities are in separate buildings, the buildings should be connected by covered walks.

8. Clear height of a laboratory should not be less than 12 ft.

9. Ventilation, including warm weather ventilation and adequate insulation, should be provided to assume a comfortable environment at all times.

10. Laboratory finishes, including accoustical materials should permit repeated refinishing.

11. Industrial Arts facility construction and installations should meet the standards of the Virginia Department of Education and the safety standards of the Virginia Department of Labor and Industry.

B. FLEXIBILITY AND EXPANSION

12. Nonbearing partitions may be used between laboratories to obtain flexibility.

13. Installations for power and other utilities should be based on a liberal rather than on a restricted estimate of future needs.

14. Standard types of cabinets, lockers, shelves, and workbenches should be used in all Industrial Arts facilities.

15. Shelving in cabinets, lockers, and other areas requiring shelves should be adjustable except where safety dictates rigid shelving.

C. SPACE NEEDS

16. The space alloted for an Industrial Arts laboratory should be adequate to provide for the various activities, including space for the proper installation and operation of equipment. The following space allotments are recommended as guides in determining space for the laboratory. These allotments are based on a class size needs of 20 students. See Table below:

TABLE 5

INDUSTRIAL ARTS LABORATORY
SPACE NEEDS
(SQ. FT.)

LABORATORY	INSTRUCTIONAL AREA	MATERIAL STORAGE	PROJECT STORAGE	EQUIPMENT	TEACHER'S OFFICE	AUXILIARY ROOMS		TOTAL SPACE NEEDS
ELEMENTARY SCHOOL								
Resource Center								1200
MIDDLE OR JUNIOR HIGH SCHOOL (GR 6-9)								
General	2650	200	200	200	100	Finishing 150		3500
Exploring Technology	2650	200	200	200	100	Finishing 150		3500
Industry & Technology	2650	200	200	200	100	Finishing 150		3500
Construction	2650	200	200	200	100			3350
Manufacturing	2650	200	200	200	100	Finishing 150		3500
SENIOR HIGH SCHOOL (GR 9-12)								
General	3000	200	200	200	200	Finishing 150		3850
Materials & Processes	3000	200	200	200	200	Finishing 150		3850
Mechanical Drawing	1600	100						1800
Communications	2000	120	100	135	135	Photo Lab 210	Dark Rm. 135	2800
Power & Transportation	2400		200			Testing 100	Adult Class Storage 200	2800
Woodworking	2650	200	250	150	150	Finishing 225		3775
Metalworking	2650	250	200	150	150	Finishing 150		3500
Electricity/Electronics	1600	100				Testing 100		1800
Graphic Arts	2650	120	125	135	100	Photo Lab 220	Dark Rm. 150	3500

D. OPEN LABORATORY/INSTRUCTIONAL AREA

17. The entire open laboratory/instructional area should be visible from any point.

18. Building mechanical equipment should not be detrimental to the use of the space for quiet instructional activity.

19. Arrangement of equipment (including machines) and student stations should be determined by considerations of safety, work procedures, flow of materials, and instructional efficiency.

20. Aisles of travel should be provided for free flow of traffic between all areas and points of common use; such as, auxiliary rooms, tool panels, and common machine areas. Aisles should be at least 4 feet in width.

21. Spacing between benches, machinery, and other equipment should be sufficient for student safety and for free passage. The amount of space between benches, machinery, and other equipment is determined by the nature of the activities and the equipment, but in all instances should be at least 3 feet.

22. Operator's zones at machines should be designated on the floor by taped or painted lines.

23. All laboratories except the mechanical drawing laboratory should have at least two entrance doors, unless an overhead door is provided.

24. Open floor space should be provided near entrances and exits to eliminate congestion.

25. A clear floor space should be provided in front of tool panels.

26. In laboratories where large projects are undertaken, adequate space should be provided for this purpose.

27. Adequate systems should be provided for the collection and disposal of dust and shavings, and the mechanical units placed outside the laboratory.

28. Special racks and shelving should be provided for the storage of lumber, bar steel, and other materials.

29. Equipment, except portable types, should be fastened securely to a stable foundation such as the floor or a heavy bench.

30. Machines that create a vibration problem should be cushioned with rubber mountings or other shock-absorbing material.

31. Bases for cabinets, benches, and machines should provide toe space.

32. Equipment should be placed to allow for ease of cleaning around the base.

33. The operating level of equipment should be a comfortable working height for the students.

34. The start-stop switch on a machine should be located within easy reach of the operator.

35. Workbenches should have lockers below.

36. Machines that are used for roughing out stock should be placed near the storage areas.

37. Lockers should be provided for students' personal belongings and partially completed small articles. Sufficient lockers for the total enrollment are necessary. These lockers should be located in an area where they can be readily supervised by the teacher.

38. Display cases should be provided.

39. Power controls should be centralized on a master control panel that can be locked and which is located near the teacher's desk or office. A readily accessible safety switch controlling the main power supply will be necessary.

40. Adequate washing facilities and a drinking fountain should be provided in each laboratory.

41. Eight foot tack board and 12 foot chalkboard should be provided and located for instructors use.

42. A first-aid kit should be provided.

43. Space should be set aside in each laboratory for waste and refuse containers.

E. AUXILIARY ROOMS

44. All auxiliary rooms and areas should be planned at the same time as the rest of the facility. Among these are rooms or areas for supplies and special tools, project storage, material storage, office, and finishing.

45. The material storage room or area should be located conveniently for unloading delivery trucks and for issuing materials to the students.

46. Where there will be evening classes an additional room for storage of these projects should be provided. Separate material and storage is also desirable.

47. Both the supply area and tool panel should be so located that students pass as few work stations as possible going and coming.

48. The supplies and special tools room should be provided with racks, shelving, drawers and closed cabinets designed for the items to be stored.

49. Instructional space in the open laboratory area is preferred to a classroom. It should be provided with a demonstration bench, chalkboard, student seating, and cabinets for storage of industrial materials.

50. One air compressor unit should suffice for several laboratories and should be located so noise from its operation will not disturb classes.

F. VISUAL COMFORT AND EFFICIENCY

51. Advantage should be taken for natural lighting where possible.

52. Lighting systems should produce uniform shadow-free light; that meet the standards of the Illuminating Engineers Society in the School Lighting Guide.

53. Lighting for laboratories in general should yield 100 foot candles on the work.

54. Local lighting for machines and areas where precision work is done would be desirable.

55. Ceilings should be painted white for better light distribution. Walls, trim, and built-in equipment should be a light color.

56. Furniture and other laboratory equipment should be finished in light colors.

57. Machinery and equipment should be painted in colors that are conducive to eye comfort and safety.

58. Color coding is required by the Virginia Department of Labor and Industry on dangerous parts and machines.

G. VENTILATION AND HEATING

59. The heating and ventilating system should be adequate to maintain comfortable and healthful conditions at all times.

60. Dust, smoke, odors, fumes, vapors, and gases should be exhausted by mechanical means.

61. Provision should be made for all engines operated in the laboratories to be muffled and connected to exhaust systems that discharge outside the building.

H. FLOORS AND SURFACES

62. The floors should be pleasing in appearance, easy to clean, made of a material that will require a minimum of repairs and finished to reduce the danger of slipping.

63. The flooring materials should differ from facility to facility according to the activities conducted. For example, nonconducting floor material should be used in electricity/electronics laboratories or areas.

64. Nonskid material should be installed on the floor in operator's zones.

PLANNING

SUMMARY

The Industrial Arts Curriculum

Level	Goal	Program
High School	Personal Enrichment	Mechanical Drawing Electricity/Electronics Graphic Arts General Industrial Arts Industrial Crafts Metalworking Woodworking Power Mechanics
	Pretechnical	Communications Technology Power and Transportation Technology Materials and Processes Technology
Middle or Junior High School	Orientation and Exploration	World of Manufacturing World of Construction Modern Industry and Technology Exploring Technology
Elementary School	Learning Reinforcement	Industrial Arts activities integrated within the elementary curriculum

TABLE 1

MIDDLE OR JUNIOR HIGH SCHOOL
INDUSTRIAL ARTS LABORATORIES SUGGESTED*

INDUSTRIAL ARTS ENROLLMENT*	NUMBER OF LABS	EXAMPLES LABORATORIES NEEDED	TOTAL SPACE NEEDS SQ. FT.
To 120	One	General	3500
160 to 240	Two	Exploring Technology Industry and Technology	7000
280 to 360	Three	Exploring Technology Industry and Technology Construction	10350
400 to 480	Four	Exploring Technology Industry and Technology Construction Manufacturing	13850

*Industrial Arts Enrollment equals 25% of Projected School Enrollment at the Middle or Junior High School Level. (Data taken from Virginia Surveys).

TABLE 3

SENIOR HIGH SCHOOL
INDUSTRIAL ARTS LABORATORIES SUGGESTED*

INDUSTRIAL ARTS ENROLLMENT*	NUMBER OF LABS	EXAMPLES OF LABORATORIES NEEDED	TOTAL SPACE NEEDS SQ. FT.
To 120	One	General	3850
160 to 240	Two	Materials and Processes Mechanical Drawing	5650
280 to 360	Three	Materials and Processes Mechanical Drawing Communications	8450
400 to 480	Four	Materials and Processes Mechanical Drawing Communications Transportation	11250
520 to 600	Five	Materials and Processes Mechanical Drawing Communications Transportation Woodworking	15025
640 to 720	Six	Materials and Processes Mechanical Drawing Communications Transportation Woodworking Metalworking	18525

*Industrial Arts enrollment equals 22% of projected school enrollment at the Senior High School. Each Trade and Industrial Education program offered in the same school will reduce the Industrial Arts enrollment by approximately 7%. When four or more Trade and Industrial Programs are provided in the school the Industrial Arts department normally does not reduce to less than 15% of the school enrollment. (Data taken from Virginia Surveys).

TABLE 5

INDUSTRIAL ARTS LABORATORY
SPACE NEEDS
(SQ. FT.)

LABORATORY	INSTRUCTIONAL AREA	STORAGE MATERIAL	STORAGE PROJECT	STORAGE EQUIPMENT	TEACHER'S OFFICE	AUXILIARY	ROOMS	TOTAL SPACE NEEDS
ELEMENTARY SCHOOL Resource Center								1200
MIDDLE OR JUNIOR HIGH SCHOOL (GR 6-9)								
General	2650	200	200	200	100	Finishing 150		3500
Exploring Technology	2650	200	200	200	100	Finishing 150		3500
Industry & Technology	2650	200	200	200	100	Finishing 150		3500
Construction	2650	200	200	200	100			3350
Manufacturing	2650	200	200	200	100	Finishing 150		3500
SENIOR HIGH SCHOOL (GR 9-12)								
General	3000	200	200	200	200	Finishing 150		3850
Materials & Processes	3000	200	200	200	200	Finishing 150		3850
Mechanical Drawing	1600	100						1800
Communications	2000	120	100	135	135	Photo Lab 210	Dark Rm. 135	2800
Power & Transportation	2400		200			Testing 100	Adult Class Storage 200	2800
Woodworking	2650	200	250	150	150	Finishing 225		3775
Metalworking	2650	250	200	150	150	Finishing 150		3500
Electricity/Electronics	1600	100				Testing 100		1800
Graphic Arts	2650	120	125	135	100	Photo Lab 220	Dark Rm. 150	3500

TABLE 6

INDUSTRIAL ARTS COURSES
ACCOMMODATED BY
RESPECTIVE LABORATORIES

	INDUSTRIAL ARTS COURSES	INDUSTRIAL ARTS LABORATORIES															
		General	Materials & Processes	Mechanical Drawing	Communications	Transportation	Woodworking	Metalworking	Electricity/Electronics	Graphic Arts	General	Exploring Technology	Industry & Technology	Construction	Manufacturing		Resource Center
GRADES 9-12	Communications Technology				X												
	Power & Transportation Technology					X											
	Materials & Processes Technology		X														
	Mechanical Drawing I, II & III			X													
	Electricity/Electronics I, II & III								X								
	Graphic Arts I, II & III									X							
	Gen. Industrial Arts I & II	X	X														
	Industrial Crafts I & II	X															
	Metalworking I, II & III							X									
	Woodworking I, II & III	X					X										
	Power Mechanics I & II																
GRADES 6-9	World of Manufacturing										0		0		X		
	World of Construction										0	0		X			
	Modern Industry and Technology										X		X		X		
	Exploring Technology										X	X		0			
K-6	Elementary School Industrial Arts											X					
	Space Needs Sq. Ft.	3850	3850	1800	2800	2800	3775	3500	1900	3500	3500	3500	3500	3500	3500		1200

SCHEDULE

X Laboratory Accomodates Course

0 Laboratory will Accomodate Course with Additional Tools and Equipment

Laboratory Accomodates Course for one-fourth Normal Class Size

EQUIPMENT GUIDELINES

Industrial Arts equipment needs should be determined by the objectives of the program, the laboratory organization, the class size and facility size.

Specific items should be chosen by evaluating in terms of the following basic guidelines. The equipment chosen should:

(1) provide meaningful and educationally sound learning experiences within the context of the specific program's objectives;

(2) be designed to minimize obsolescence and allow for maximum flexibility; (it must be recognized that in a world of change the school will need to "retool" periodically just as industry does);

(3) be unit type machines designed for major processes (e.g., circular saw, drill press and milling machine);

(4) be equipped with effective guards and devices to insure the safety of the student;

(5) accomodate the age, strength, height and mentality of the students in the class;

(6) be of a size or capacity which will accomodate the majority of the activities to be carried out;

(7) be compatible with the power supply and utilities available.